A Transient Soil Seed Bank for the Yam-daisy *Microseris scapigera*

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Abstract

An experiment was undertaken to assess the longevity of *Microseris scapigera* seeds in the soil. Seeds were buried in small bags of nylon mesh in a long-ungrazed and long-unburnt *Themeda* grassland in Canberra. Replicate seed bags were unearthed after 3, 8 and 12 months. *M. scapigera* was found to have a transient soil seedbank, since virtually all seeds germinated rapidly, and no viable seeds persisted for longer than 3 months. The implications of these results for the conservation management of *M. scapigera* in remnant grasslands are discussed. (*The Victorian Naturalist* **113** (1) 1996, 16-19)

Introduction

Two centuries ago, Yam-daisies (Fig. 1), or Murnong (*Microseris scapigera*), were abundant across the grassy plains of south-eastern Australia, providing a nutritious food supply for many Aboriginal tribes (Gott 1983). One European settler reported 'millions of murnong or yam, all over the plain', and the wheels of E.M. Curr's dray 'used to turn them up by the bushel' (Gott 1983).

However, Yam-daisies proved extremely palatable to sheep and rabbits (Farrington and Mitchell 1966; Cunningham *et al.* 1981; Gott 1983), as noted by Curr: 'several thousand sheep not only learnt to root up these vegetables [murnong] with their noses, but they for the most part lived on them for the first year, after which the root began to get scarce' (Curr 1886, in Gott 1983).

Microseris scapigera is now uncommon to rare in lowland grasslands and grassy woodlands, and most large grassland populations occur in ungrazed remnants on roadsides, rail-lines and cemeteries (Prober and Thiele 1993; McDougall and Kirkpatrick 1994). Fortunately, the species remains common in other, less disturbed ecosystems, such as dry selerophyll forests. Recently, as part of a larger experiment with ten grassland species, I investigated the longevity of *M. scapigera* seeds in the soil. Seed longevity is a critical factor in plant ecology, as long-lived seeds can form a buried seed bank, which enables a population to re-establish after mature plants are killed (e.g. by fire or grazing). By contrast, if all seeds germinate quickly, the population cannot recover if all existing plants die before flowering, unless new seeds migrate into the site.

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Methods

Microseris scapigera seeds (propagules of *Microseris scapigera* are technically called 'achenes', but are here called 'seeds' for simplicity) were collected in November 1993 from a remnant *Themeda* grassland in Canberra, ACT. They were dried and stored indoors until early 1994, when they were placed in bags of fine nylon mesh (mesh size 0.85 mm x 0.95 mm). Twenty filled seeds were placed in each bag, and broken and unfilled seeds

Fig. 1. *Microseris scapigera* (Photograph courtesy of James Ross).

were discarded. On 27 May 1994, the bags were buried in a closed *Themeda* grassland in the Majura Valley next to Canberra Airport.

The study site supported a long-unburnt and long-ungrazed natural grassland with a dense, closed canopy of *Themeda triandra*. Associated species included *Asperula conferta*, *Desmodium varians*, *Eragrostis trachycarpa*, *Plantago varia*, *Tricoryne elatior* and the exotic herbs, *Conyza* species, *Hypochoeris radicata* and *Tragopogon porrifolius*. The soil was a dark brown, silty clay loam of pH 6.1 (S. Sharp 1995, *pers. comm.*). Weather conditions during most of the experiment were extremely dry, as the region was experiencing a severe drought.

The bags were arranged (with more bags containing seeds of other species) at regular intervals on a grid measuring 19 m x 19.5 m. Half of the seed bags were pinned to the soil surface, beneath the closed grass canopy, and the other half were buried approximately 1 cm deep. Eight surface and eight buried bags were unearthed after approximately 3, 8 and 12 months. In total, 160 buried and 160 surface seeds were unearthed at each date.

Results and discussion

Virtually all *M. scapigera* seeds germinated rapidly, and no viable seeds persisted for longer than 3 months (Table 1). Two intact and visually healthy seeds were recovered at 3 months (Table 1), but their viability remains questionable as neither could be induced to germinate in a petri dish. A few intact seeds were recovered after eight and 12 months, but all were brown inside and obviously inviable.

Table 1. Percentage of *Microseris scapigera* seeds remaining viable after various periods in the soil.

Date	Event	Surface seeds	Buried seeds
27 May 1994	seeds sown	100.00	100.00
29 August 1994	first recovery (3 months)	1.00	0.00
19 January 1995	second recovery (8 months)	0.00	0.00
6 May 1995	third recovery (12 months)	0.00	0.00

Microseris scapigera germination was not inhibited by a dense grass cover or extremely low soil moisture levels. In August 1994, when the first seeds were unearthed, the topsoil was completely dry and dusty, and few seeds of the other species studied had germinated (Lunt, *unpubl.*). Drought conditions persisted throughout 1994, and there seems little doubt that all *M. scapigera* seedlings would have perished.

Little information is available on seed persistence in Australian grassland herbs. M. scapigera was the only species, of the ten studied in Canberra, for which no seeds remained viable after a year in the soil (Lunt, *unpubl.*). At least 20% of the seeds of each of the other species remained viable after 12 months. Indeed, more than 70% of *Vittadinia muelleri* seeds, and over 80% of surface seeds of *Briza maxima* remained viable after a year in the field (Lunt, *unpubl.*). Seeds of the grassland daisies, *Chrysocephalum apiculatum* and *Leucochrysum albicans*, can remain viable in the soil for at least a year (Gilfedder and Kirkpatrick 1993; Lunt 1995), whereas most seeds of species such as *Burchardia umbellata*, *Craspedia variabilis* and *Rutidosis leptorrhynchoides* rapidly germinate in native grasslands, with few seeds remaining viable after 6 months (Lunt 1995; Morgan 1995). Like *M. scapigera*, *R. leptorrhynchoides* has declined dramatically in abundance since European settlement.

The data presented here were obtained from seeds from one population, grown at one place in just one year, and it remains to be seen whether seeds from other populations behave similarly. The grassland habitat at Canberra is structurally similar to any unburnt and ungrazed grasslands in south-east Australia (e.g. Lunt 1990; McDougall and Kirkpatrick 1994). *Microseris scapigera* is a variable species with many distinct forms (Gott 1983), and seed behaviour may well differ between populations, as occurs in *Leucochrysum albicans* (Gilfedder and Kirkpatrick 1994).

However, in a concurrent experiment in the Melbourne area, Watson (1995) found that less than 2% of *M. scapigera* seeds remained viable after being buried for 6 months in a recently burnt native grassland, and no seeds remained viable after being buried for 6 months in an unburnt grassland, which accords with the results found here.

The absence of a persistent seed bank for *M. scapigera* has three major implications for conservation management, especially in productive grassland remnants which rapidly accumulate a thick grass cover after fire.

1. If mature *M. scapigera* plants are absent before a fire or other disturbance, then no seedling recruitment can be expected after the disturbance, unless seeds are introduced to the site. (Although *M. scapigera* seeds have a large pappus, it is scaly and lacks feathery appendages, and seeds are unlikely to be dispersed into isolated remnants by wind).

2. If mature plants do occur at the site, then substantial recruitment can only occur immediately after a year of high flower and seed production, as few (if any) viable seeds will be present in other years (Lunt 1994).

3. If mature plants do occur at the site, then seedling recruitment is unlikely to occur immediately after spring burning, as most (if not all) seeds will have germinated earlier in the year. Small seedlings are likely to be killed by a high intensity fire. (Seedling recruitment may occur in future years though).

If this model proves to be correct, then the principal impact of fire on grassland forbs with transient soil seed banks, may be to enable existing plants to produce more flowers and seeds, from which new seedlings can grow in the following year. This scenario of delayed post-fire recruitment differs from the model of direct, fire-promoted recruitment from a soil seed bank, which is commonly reported from forest ecosystems (e.g. Purdie 1977; Wark et al. 1987).

The absence of a persistent seed bank in the soil may provide an additional clue to the rapid demise of *M. scapigera* following European colonisation. The unearthing of mature plants, selective grazing of surviving plants, and absence of buried seeds, led to the irretrievable demise of this once-abundant species. This scenario echoes the conclusion of many writers (e.g. Groves and Williams 1981; Kirkpatrick et. al. 1988), that the most dramatic changes to grassland ecosystems occurred extremely quickly, within the first few years of occupation by Europeans and their sheep.

Acknowledgments

This project was funded by the Australian Nature Conservation Agency, under a grassland research grant administered by the ACT Parks and Conservation Service. Considerable thanks are due to Sarah Sharp, who collected the seeds, selected the study site and provided accommodation and administrative assistance throughout the project. Pat Tratt and Raz Martin helped count the initial seed lots and sewed the seed bags. Gill Earl, John Morgan, Bob Parsons and Sarah Sharp kindly commented upon the manuscript and James Ross provided the photograph.

References

Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. and Leigh, J.H. (1981). 'Plants of Western New South Wales'. (Soil Conservation Service of New South Wales: Sydney).

Curr, E.M. (1886). 'The Australian Race'. (Government Printer: Melbourne).

Farrington, P. and Mitchell, A. (1966). The Effects of Grazing by Sheep and Rabbits in a Victorian Forest. (Unpubl. Report, Soil Conservation Authority Victoria: Melbourne).

Gilfedder, L. and Kirkpatrick, J.B. (1993). Germinable soil seed and competitive relationships between a rare native species and exotics in a semi-natural pasture in the Midlands, Tasmania. *Biological Conservation* **64**, 113-119.

Gilfedder, L. and Kirkpatrick, J.B. (1994). Genecological variation in the germination, growth and morphology of four populations of a Tasmanian endangered perennial daisy, Leucochrysum albicans. *Australian Journal of Botany* **42**, 431-440.

Gott, B. (1983). Murnong - Microseris scapigera: a study of a staple food of Victorian Aborigines. *Australian Aboriginal Studies* **2**, 2-18.

Groves, R.H. and Williams, O.B. (1981). Natural grasslands. *In* 'Australian Vegetation'. Ed R.H. Groves. (Cambridge University Press: Cambridge).

Kirkpatrick, J., Gilfedder, L. and Fensham, R. (1988). 'City Parks and Cemeteries - Tasmania's Remnant Grasslands and Grassy Woodlands'. (Tasmanian Conservation Trust: Hobart).

Lunt, I.D. (1990). A floristic survey of the Derrimut Grassland Reserve, Melbourne, Victoria. *Proceedings of the Royal Society of Victoria* **102**, 41-51.

Lunt, I.D. (1994). Variation in flower production of nine grassland species with time since fire, and implications for grassland management and restoration. *Pacific Conservation Biology* **1**, 359-366.

Lunt, I.D. (1995). Seed longevity of six native forbs in a closed Themeda triandra grassland. *Australian Journal of Botany* **43**, 439-449.

McDougall, K. and Kirkpatrick, J.B. (eds) (1994). 'Conservation of Lowland Native Grasslands in South-eastern Australia.' (World Wide Fund for Nature: Sydney).

Morgan, J.W. (1995). Ecological studies of the endangered Rutidosis leptorrhynchoides. I. Seed production, soil seed bank dynamics, population density and their effects on recruitment. *Australian Journal of Botany* **43**, 1-11.

Prober, S.M. and Thiele, K.R. (1993). The ecology and genetics of remnant grassy white box woodlands in relation to their conservation. *The Victorian Naturalist* **110**, 30-36.

Purdie, R.W. (1977). Early stages of regeneration after burning in dry sclerophyll vegetation. II. Regeneration by seed germination. *Australian Journal of Botany* **25**, 35-46.

Wark, M.C., White, M.D., Robertson, D.J. and Marriott, P.H. (1987). Regeneration of heath and heath woodland in the north-eastern Otway Ranges following the wild-fire of February 1983. *Proceedings of the Royal Society of Victoria* **99**, 51-88.

Watson, S. (1995). Seed Ecology Of Five Native Forbs. *In* 'A Basalt Plains Grassland'. (Unpublished thesis, Victorian College of Agriculture and Horticulture, Burnley: Melbourne).

Mueller - Commemorative Issue
The Victorian Naturalist
August 1996

1996 is the centenary of the death of Baron Ferdinand von Mueller. A special issue of The Victorian Naturalist will be published in August 1996 to commemorate Mueller's involvement with the FNCV as a foundation member, and as its first patron.

For this issue we have invited a number of authors to write on a variety of topics including Mueller's collecting work, his and the club's involvement with Wilsons Promontory, the FNCV's contribution towards his monument in St Kilda cemetery, as well as other aspects of his wider natural history interests.

We invite **YOU** to contribute to this commemorative issue by writing on anything you know about Mueller. If you do not want to write, perhaps you have some suggestions for topics or articles that you would like to see included? Please let us know, ***as soon as possible***, if you have any suggestions or are able to write for the journal. Written material will be needed by the end of May 1996.

The editors are looking forward to hearing from you.

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